**Department of Physics**

**Mahatma Gandhi College**

**Thiruvananthapuram**

**FIRST DEGREE PROGRAMME IN PHYSICS**

UNDER CHOICE BASED-CREDIT & SEMESTERSYSTEM (CBCSS)

(2018 admission onwards)

**PROGRAMME OUTCOME**

1. Bridges the gap between plus two and Post graduation
2. Creates interest in theoretical and experimental Science
3. Improves the quantitative reasoning and problem solving skills
4. Prepared to work on forefront areas in science
5. Improves the employability
6. Enhance the student’s academic abilities, personal qualities and transferable skills this will give them an opportunity to develop as responsible citizens
7. Motivate the students to pursue PG courses in reputed institutions
8. Produce graduates who excel in the competencies and values required for leadership to serve a rapidly evolving global community
9. Collaborate effectively on team-oriented projects in the field of Physics

**PROGRAMME SPECIFIC OUTCOME**

**PSO1**: Understand the fundamentals of basic Mechanics, Properties of Matter and Thermodynamics

**PSO2**: Understands the theoretical basis of Electrodynamics and Classical Mechanics and Relativistic Mechanics

**PSO3**: Understand the theoretical basis of Quantum Mechanics, Atomic and Molecular Physics, Electronics, Statistical Physics, Disaster Management, and Research Methodology, Astronomy and Astrophysics

**PSO4**: Understand the theoretical basis of Nuclear Physics, Optics, Solid State Physics and Nano Science and Technology

**PSO5**: Apply and verify theoretical concepts through laboratory experiments

**PSO6**: Understand the basics of computer programming and numerical analysis

**Course Outcomes**

**PY1141 Basic Mechanics and Properties of Matter**

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| CO | Course Outcome | PSO |
| CO1 | Understands the concepts of rigid bodies, moment of inertia and angular momentum | PSO1 |
| CO2 | Defines theorems on moment of inertia | PSO1 |
| CO3 | Determines the moment of inertia of various bodies | PSO1 |
| CO4 | Learns conservations laws and work energy theorem | PSO1 |
| CO5 | Understands simple harmonic motion and oscillations | PSO1 |
| CO6 | Understands basic ideas of elasticity | PSO1 |
| CO7 | Determines Young’s Modulus using uniform bending, nonuniform bending and cantilever methods  | PSO1 |
| CO8 | Understands surface tension and viscosity | PSO1 |

**PY1241 Heat and Thermodynamics**

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| --- | --- | --- |
| CO | Course Outcome | PSO |
| CO1 | Defines thermal conductivity | PSO1 |
| CO2 | Determines of thermal conductivity of bad conductor | PSO1 |
| CO3 | Understands radiation laws | PSO1 |
| CO4 | Determines temperature of Sun | PSO1 |
| CO5 | Defines laws of thermodynamics | PSO1 |
| CO6 | Applies laws of thermodynamics to determine the efficiency of various heat engines | PSO1 |
| CO7 | Compares the working and efficiency of various heat engines |  |
| CO8 | Understands the concept of entropy | PSO1 |

**PY1341 Electrodynamics**

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| CO | Course Outcome | PSO |
| CO1 | Defines basics laws of Electrostatistics | PSO2 |
| CO2 | Understands the concept of electric potential | PSO2 |
| CO3 | Applies Gauss law to determine the Electric field due to charged bodies of various shapes | PSO2 |
| CO4 | Understands the basis of electric polarization | PSO2 |
| CO5 | Compares the electric field in a charge free region and dielectric | PSO2 |
| CO6 | Understands the concepts of electromagnetic induction | PSO2 |
| CO7 | Derives Maxwell’s Electromagnetic equation | PSO2 |
| CO8  | Derives the expression of velocity of electromagnetic waves | PSO2 |
| CO9 | Understands the growth and decay of transient current in resistors, inductance and capacitors | PSO2 |
| CO10 | Derives the mathematical expression which describes the phase relationship between voltage and current when A.C. currents flows in combinations of various electric elements such as resistors, inductors and capacitors | PSO2 |

**PY1441 Classical and Relativistic Mechanics**

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| CO | Course Outcome | PSO |
| CO1 | Derives the equation of motion of particles | PSO2 |
| CO2 | Applies the equation of motion in electric and magnetic fields | PSO2 |
| CO3 | Understands the conservation laws | PSO2 |
| CO4 | Understands the motion in a central force field | PSO2 |
| CO5 | Derives equation of an orbit and applies to derive Kepler’s laws of motion | PSO2 |
| CO6 | Understands scattering and collisions  | PSO2 |
| CO7 | Compares the laboratory and centre of mass systems | PSO2 |
| CO8  | Understands Lagrangian and Hamiltonian formulations | PSO2 |
| CO9 | Applies Langragian equations to derives equations of motion of simple pendulum, compound pendulum, Atwood’s machine etc., | PSO2 |
| CO10 | Compares Langrangian approach and Newtonian approach | PSO2 |
| CO11 | Compares inertial and noninertial frames of reference | PSO2 |
| CO12 | Understands Galilean transformation | PSO2 |
| CO13 | Understands Special theory of relativity | PSO2 |
| CO14 | Applies special theory of relativity to understand length contraction, time dilation and twin paradox | PSO2 |
| CO15 | Derives mass energy equivalent equation | PSO2 |

**PY 1541 Quantum Mechanics**

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| CO | Course Outcome | PSO |
| CO1 | Understands the limitations of Classical Mechanics | PSO3 |
| CO2 | Understands Photoelectric and Compton effects | PSO3 |
| CO3 | Understand wave nature of particles and electron diffraction | PSO3 |
| CO4 | Understands wavefunction and its physical interpretation | PSO3 |
| CO5 | Derives time dependent and independent Schrodinger equation | PSO3 |
| CO6 | Applies Schrodinger time independent equation to study the physical situations such as particle in a box and harmonic oscillator | PSO3 |
| CO7 | Understands the general formalism of quantum mechanics  | PSO3 |
| CO8  | Defines the postulates of quantum mechanics | PSO3 |

**PY 1542 Statistical Physics, Research Methodology and Disaster Management**

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| CO | Course Outcome | PSO |
| CO1 | Understands the concepts of macro and microstates, phase space, statistical ensemble | PSO3 |
| CO2 | Derives the Maxwell Boltzmann, Bose Einstein and Fermi Dirac statistics | PSO3 |
| CO3 | Compares the three statistics | PSO3 |
| CO4 | Understands the objectives of research | PSO3 |
| CO5 | Understands different types of research and research approaches | PSO3 |
| CO6 | Understands various steps in a research process | PSO3 |
| CO7 | Understands basic steps in report writing | PSO3 |
| CO8  | Understands the basic ideas of error analysis | PSO3 |
| CO9 | Understands the natural and manmade hazards and disasters | PSO3 |
| CO10 | Understands different relief efforts | PSO3 |
| CO11 | Understands the impacts of global climate change | PSO3 |

**PY 1543 Electronics**

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| CO | Course Outcome | PSO |
| CO1 | Defines Kirchoff’s laws | PSO3 |
| CO2 | Applies Thevenin’s, Norton’s and Maximum Power Transfer theorems to obtain voltage and current in circuit elements | PSO3 |
| CO3 | Distinguishes between intrinsic and extrinsic semiconductors | PSO3 |
| CO4 | Distinguishes between p type and n type semiconductors | PSO3 |
| CO5 | Understands about pn junction diodes | PSO3 |
| CO6 | Compares the forward and reverse biasing of diodes | PSO3 |
| CO7 | Constructs half wave and full wave rectifiers using diodes | PSO3 |
| CO8  | Compares different types of filters | PSO3 |
| CO9 | Applies the properties of Zener diode to construct a voltage regulator | PSO3 |
| CO10 | Understands the working of bipolar junction transistors | PSO3 |
| CO11 | Compares CE, CB and CC configurations | PSO3 |
| CO12 | Construct the circuit of an CE amplifier with biasing | PSO3 |
| CO13 | Compares Class A, Class B and Class C amplifiers | PSO3 |
| CO14 | Distinguishes between positive and negative feedback  | PSO3 |
| CO15 | Understands the working of different oscillators | PSO3 |
| CO16 | Understands the fundamentals of modulation | PSO3 |
| CO17 | Understands the amplitude and frequency modulations | PSO3 |
| CO18 | Understands the working of Operational Amplifier | PSO3 |

**PY1544 Atomic and Molecular Physics**

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| CO | Course Outcome | PSO |
| CO1 | Understands Bohr Atom Model and Sommerfeld Atom Model | PSO3 |
| CO2 | Understands the Vector Atom Model | PSO3 |
| CO3 | Understands the classical and quantum mechanical explanation of Zeeman effect | PSO3 |
| CO4 | Distinguishes normal and anomalous Zeeman effect | PSO3 |
| CO5 | Understands the properties of X-rays | PSO3 |
| CO6 | Distinguishes between the continuous and characteristic spectra of X-ray | PSO3 |
| CO7 | Distinguishes between vibrational and rotational spectra | PSO3 |
| CO8  | Understands Raman effect | PSO3 |
| CO9 | Differentiate between Stoke’s and Antistoke’s lines | PSO3 |
| CO10 | Understands NMR and ESR Spectroscopy | PSO3 |

**PY 1551.2 Astronomy and Astrophysics**

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| CO | Course Outcome | PSO |
| CO1 | Understands the basics of Astronomy | PSO3 |
| CO2 | Understands constellation, stellar magnitudes | PSO3 |
| CO3 | Understands the history of Astronomy | PSO3 |
| CO4 | Understands the solar properties and solar system | PSO3 |
| CO5 | Understands the properties and spectral types of stars | PSO3 |
| CO6 | Familiarises Milky Way Galaxy | PSO3 |

**PY1641 Solid State Physics**

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| CO | Course Outcome | PSO |
| CO1 | Distinguishes between crystal and amorphous solids | PSO4 |
| CO2 | Understands the basics of a crystal structure | PSO4 |
| CO3 | Derives the equation for interlattice spacing using Miller indices | PSO4 |
| CO4 | Understands the reciprocal lattice and Brillouine zones | PSO4 |
| CO5 | Compares different types of bonding in solids | PSO4 |
| CO6 | Understands free electron model | PSO4 |
| CO7 | Explains the electrical and thermal properties of metals using free electron model  | PSO4 |
| CO8  | Understands the Kronig Penney model based on band theory | PSO4 |
| CO9 | Understands Hall effect | PSO4 |
| CO10 | Understands the dielectric properties of solids | PSO4 |
| CO11 | Derives Clausius Masotti equation | PSO4 |
| CO12 | Explains polarization based on classical theory | PSO4 |
| CO13 | Distinguishes between dia, para and ferro magnetic materials  | PSO4 |
| CO14 | Explains paramagnetism based on classical and quantum mechanical explanation of theories | PSO4 |
| CO15 | Explains ferromagnetism based on domain theory | PSO4 |
| CO16 | Understands the properties of superconductors | PSO4 |
| CO17 | Distinguishes between Type I and Type II superconductors | PSO4 |
| CO18 | Explains superconductivity based on BCS theory | PSO4 |

**PY1642 Nuclear Physics and Elementary Particles**

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| CO | Course Outcome | PSO |
| CO1 | Understands the properties of nucleus | PSO4 |
| CO2 | Understands the properties of nuclear forces | PSO4 |
| CO3 | Derives semi empirical mass formula based on liquid drop model  | PSO4 |
| CO4 | Explains nuclear structure and properties based on liquid drop model, shell model and collective model | PSO4 |
| CO5 | Understands the basics of α-decay | PSO4 |
| CO6 | Explains α, β and γ decay | PSO4 |
| CO7 | Determines Q value in a nuclear reaction | PSO4 |
| CO8  | Explains the working of particle detectors and accelerators | PSO4 |
| CO9 | Understand nuclear fission and fusion reactions | PSO4 |
| CO10 | Explains the working of atom bomb | PSO4 |
| CO11 | Explains the working of atomic reactor | PSO4 |
| CO12 | Explains various confinement techniques of plasma | PSO4 |
| CO13 | Classifies various elementary particles | PSO4 |
| CO14 | Identifies the possible nuclear reactions based on conservation laws | PSO4 |

**PY 1643 Classical and Modern Optics**

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| CO | Course Outcome | PSO |
| CO1 | Understands the principle of superposition | PSO4 |
| CO2 | Derives the expression for fringe width  | PSO4 |
| CO3 | Distinguishes interference due to division of amplitude and division of wavefront | PSO4 |
| CO4 | Explains various experiments to determine the wavelength of monochromatic light using interference | PSO4 |
| CO5 | Distinguishes between Fresnel and Fraunhofer diffraction | PSO4 |
| CO6 | Explains diffraction due to straight edge, single slit, double slit and grating | PSO4 |
| CO7 | Determines resolving power of grating by applying Rayleigh’s criterion of resolution | PSO4 |
| CO8  | Understands different methods to produce polarized light | PSO4 |
| CO9 | Distinguishes plane polarized, circularly and elliptically polarized light | PSO4 |
| CO10 | Explains the working of a Nicol prism and polarizer and analyser | PSO4 |
| CO11 | Understands the properties of LASER | PSO4 |
| CO12 | Derives the expression for Einstein’s coefficients | PSO4 |
| CO13 | Explains the working of Ruby, He-Ne, Dye and semiconductor lasers  | PSO4 |
| CO14 | Understands the structure of optical fibre | PSO4 |
| CO15 | Distinguishes between step and GRIN fibre | PSO4 |
| CO16 | Explains the fibre optic communication | PSO4 |
| CO17 | Explains various steps in preparing hologram | PSO4 |

**PY 1644 Digital Electronics and Computer Science**

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| CO | Course Outcome | PSO |
| CO1 | Understands various number systems | PSO4 |
| CO2 | Converts numbers between various number systems | PSO4 |
| CO3 | Understands Boolean algebra and logic gates | PSO4 |
| CO4 | Constructs various arithmetic circuits | PSO4 |
| CO5 | Understands basics of a computer system | PSO4 |
| CO6 | Develops programmes in C++ language | PSO4 |
| CO7 | Understands microprocessors | PSO4 |

**PY1661.4 Nano Science and Technology**

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| --- | --- | --- |
| CO | Course Outcome | PSO |
| CO1 | Understands the basics of nano materials | PSO4 |
| CO2 | Understands electrical conductivity in nano materials | PSO4 |
| CO3 | Understands the growth mechanism in nano materials | PSO4 |
| CO4 | Understands various characterization tools of nano materials | PSO4 |
| CO5 | Understands the application of nano materials | PSO4 |

**PY1442 Basic Physics Lab 1**

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| --- | --- | --- |
| CO | Course Outcome | PSO |
| CO1 | Apply and illustrate the concepts of oscillations through experiments | PSO5 |
| CO2 | Apply and illustrate the concepts of basic mechanics through experiments | PSO5 |
| CO3 | Apply and illustrate the concepts of properties of matter through experiments | PSO5 |

**PY1645 Advanced Physics Lab 2**

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| --- | --- | --- |
| CO | Course Outcome | PSO |
| CO1 | Apply and illustrate the concepts of electricity and magnetism through experiments | PSO5 |
| CO2 | Apply and illustrate the concepts of optics through experiments | PSO5 |

**PY1646 Advanced Physics Lab 3**

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| --- | --- | --- |
| CO | Course Outcome | PSO |
| CO1 | Apply and illustrate the principles of semiconductor diode and transistor through experiments | PSO5 |
| CO2 | Apply and illustrate the principles of digital electronics through experiments | PSO5 |
| CO3 | Analyze and apply computational techniques in C++ programming | PSO6 |

**PY1647 Project**

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| CO | Course Outcome | PSO |
| CO1 | Understand research methodology | PSO3 |
| CO2 | Understand and formulate a research project | PSO3 |
| CO3 | Design and implement a research project | PSO3 |
| CO4 | Identify and enumerate the scope and limitations of a research project | PSO3 |